LS-86
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October 1988

SUPERCONDUCTING CAVITIES IN THE LIGHT SOURCE STORAGE RING

The synchrotron radiation loss in the Conceptual Design Report (CDR) storage ring at the design energy of 6 GeV is 4.6 MeV per turn. At 7.7 GeV, the energy loss will increase to 12.5 MeV per turn. Instead of increasing the ring circumference, one can increase the rf voltage per straight section by using superconducting cavities. Several laboratories (CERN, KEK, DESY) are making definite plans to use them. Accelerating fields of at least 3 MeV/m are obtained.

The spherical and elliptical cavity shapes reduce the problem of multipactoring. The main problems of using superconducting cavities in "high current" storage are the input coupling of the fundamental mode and the couplers for damping the higher-order modes (HOM). For the fundamental mode, the input coupler must be able to handle the beam power, which is much larger than the rf losses (loaded $Q \sim 10^5$, unloaded $Q_o \sim 10^9$). In particular, during the filling of the storage ring, one has a discontinuous increase of the beam power. The tuning mechanism must be able to keep the cavities in resonance, which is more difficult for superconducting cavities because of the small band width. To suppress coupled bunch instabilities excited by HOM fields, the cavities must be coupled to a damping mechanism. From beam tests conducted at Cornell and DESY, one may expect to obtain 10 MV per straight section and about 5 mA per bunch. Using two straight sections (maximum voltage 20 MV per turn), one can have:

Maximum energy	8 GeV
Bending magnet radiation loss per turn	14.54 MeV
Insertion device loss per turn	4.00 MeV
Sin ϕ_s = 0.927 and longitudinal quantum lifetime	>2500 h